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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/662,365	09/16/2003	Jang Fung Chen	55071-280	9422

7590 03/18/2004
McDermott, Will & Emery
600 13th Street, N.W.
Washington, DC 20005-3096

EXAMINER

ROSASCO, STEPHEN D

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 03/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/662,365

Applicant(s)

CHEN ET AL.

Examiner

Stephen Rosasco

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 9/16/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claims 1-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The use of the word mask in the preamble that comprises in the body of the claim, a phase shift and a non-phase shift mask is unclear. And then, in the dependent claims, which refer to the mask of claim 1, it is unclear or at least awkward as to which mask in claim 1 is being referred to.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Nakao (5,882,827).

The claimed invention is directed to a method of making a mask for transferring a lithographic pattern onto a substrate by use of a lithographic exposure apparatus, said mask comprising: at least one non-critical feature, formed utilizing one of a low-transmission phase-shift mask and a non-phase-shifting mask, and at least one critical feature, formed utilizing a high-transmission phase-shifting mask.

The applicant discusses the limitations of the attenuating and alternating phase shift masks. The altPSM eliminates the 0th diffraction order and is considered the stronger PSM. It

has higher resolution but a stronger optical proximity effect (OPE). The attPSM is considered a weaker PSM, with less resolution enhancement but with also lesser degree of OPE.

The claimed mask is a hybrid, which employs regions of the altPSM for those areas requiring a higher critical dimension, and regions of the attPSM for those areas that do not require the higher critical dimension.

Nakao teaches a mask and a method of manufacturing a phase shift mask provided with a phase shift portion of Levenson type and a phase shift portion of Halftone type, comprising the steps of: forming a semi-shading shifter film and a shading film successively stacked on an entire surface of a substrate;

wherein said semi-shading shifter film is formed such that it has a transmittance of at least 3% and at most 30% and phase of exposure light before transmitted through said semi-shading shifter film is different from that after transmitted therethrough, the method further comprising: selectively removing said shading film and said semi-shading shifter film such that said shading film and said semi-shading shifter film expose a surface of said substrate at first and second light transmitting regions adjacent to each other with a shading region of said phase shift portion of Levenson type therebetween and at a fourth light transmitting region adjacent to a third light transmitting region of said phase shift portion of Halftone type, and covers a surface of said substrate at said shading region of said phase shift portion of Levenson type and said third light transmitting region of said phase shift portion of Halftone type;

forming a trench at an entire surface of said substrate where any of said first or second light transmitting regions is exposed such that phase of exposure light transmitted through said first light transmitting region is different from that transmitted through said second light transmitting region; and

removing said shading film at said third light transmitting region.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 1-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Lin et al. (6,210,841).

The claimed invention is directed to a method of making a phase shift mask and the mask. The applicant discusses the limitations of the attenuating and alternating phase shift masks. The altPSM eliminates the 0th diffraction order and is considered the stronger PSM. It has higher resolution but a stronger optical proximity effect (OPE). The attPSM is considered a weaker PSM, with less resolution enhancement but with also lesser degree of OPE.

The claimed mask is a hybrid, which employs regions of the altPSM for those areas requiring a higher critical dimension, and regions of the attPSM for those areas that do not require the higher critical dimension.

Lin et al. teach a mask used to form images on an integrated circuit wafer, comprising: a transparent mask substrate having a first pattern region and a second pattern region; an opaque first pattern formed on said transparent mask substrate in said first pattern region, wherein said first pattern is formed of opaque material directly over attenuating phase shifting material and comprises a first number of parallel first lines having a first line width and a first duty ratio and wherein said first duty ratio is the ratio of said first line width to the distance between adjacent said first lines;

Art Unit: 1756

a second pattern formed from said attenuating phase shifting material on said transparent mask substrate in said second pattern region, wherein said second pattern comprises a second number of parallel second lines having a second line width and a second duty ratio, and said second duty ratio is the ratio of said second line width to the distance between adjacent said second lines.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakao (5,882,827) or Lin et al. (6,210,841).

The claimed invention is directed to a method of making a phase shift mask and the mask. The applicant discusses the limitations of the attenuating and alternating phase shift masks. The altPSM eliminates the 0th diffraction order and is considered the stronger PSM. It has higher resolution but a stronger optical proximity effect (OPE). The attPSM is considered a weaker PSM, with less resolution enhancement but with also lesser degree of OPE.

The claimed mask is a hybrid, which employs regions of the altPSM for those areas requiring a higher critical dimension, and regions of the attPSM for those areas that do not require the higher critical dimension.

Nakao teaches a mask and a method of manufacturing a phase shift mask provided with a phase shift portion of Levenson type and a phase shift portion of Halftone type, comprising the steps of: forming a semi-shading shifter film and a shading film successively stacked on an entire surface of a substrate;

wherein said semi-shading shifter film is formed such that it has a transmittance of at least 3% and at most 30% and phase of exposure light before transmitted through said semi-shading shifter film is different from that after transmitted there through, the method further comprising: selectively removing said shading film and said semi-shading shifter film such that said shading film and said semi-shading shifter film expose a surface of said substrate at first and second light transmitting regions adjacent to each other with a shading region of said phase shift portion of Levenson type therebetween and at a fourth light transmitting region adjacent to a third light transmitting region of said phase shift portion of Halftone type, and covers a surface of said substrate at said shading region of said phase shift portion of Levenson type and said third light transmitting region of said phase shift portion of Halftone type;

forming a trench at an entire surface of said substrate where any of said first or second light transmitting regions is exposed such that phase of exposure light transmitted through said first light transmitting region is different from that transmitted through said second light transmitting region; and

removing said shading film at said third light transmitting region.

Lin et al. teach a mask used to form images on an integrated circuit wafer, comprising: a transparent mask substrate having a first pattern region and a second pattern region;

an opaque first pattern formed on said transparent mask substrate in said first pattern region, wherein said first pattern is formed of opaque material directly over attenuating phase shifting material and comprises a first number of parallel first lines having a first line width and a first duty ratio and wherein said first duty ratio is the ratio of said first line width to the distance between adjacent said first lines;

a second pattern formed from said attenuating phase shifting material on said transparent mask substrate in said second pattern region, wherein said second pattern comprises a second

Art Unit: 1756

number of parallel second lines having a second line width and a second duty ratio, and said second duty ratio is the ratio of said second line width to the distance between adjacent said second lines.

The teachings of Nakao or Lin et al. differ from those of the applicant in that the applicant teaches the use of some different percentages of attenuation. However, the use of different amounts of attenuation is well known in the art and it would have been obvious to one having ordinary skill in the art to take the teachings of Nakao or Lin et al. and adjust the degree of attenuation in order to make the mask and method of the applicant because it would be considered an obvious modification dependent on the specific design of the mask patterns.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to S. Rosasco whose telephone number is (703) 308-4402.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0661. Fax (703) 305-3599.

A handwritten signature in black ink, appearing to read 'S. Rosasco', with a stylized, looped initial 'S'.

S. Rosasco
Primary Examiner
Art Unit 1756

S. Rosasco
3/11/04